REMARKS

Applicants respectfully request entry of the amendments and remarks submitted herein. Claims 1 and 14 have been amended herein and new claims 22-25 have been added. Claims 1 and 14 have been changed to refer to "cylindrical" reactor body instead of "tubular" reactor body. Support for these amendments can be found, for example, in the first line of the last paragraph on page 6. New claims 22 and 23 are dependent claims; support for new claims 22 and 23 can be found, for example, at page 7, second full paragraph, and page 11, first full paragraph. New claims 24 and 25 are re-written versions of claims 1 and 14; however, in new claims 1 and 14, the addition of reagents is not optional. No new matter has been added by these amendments.

Claims 1-16, 20 and 22-25 are currently pending. Reconsideration of the pending application is respectfully requested.

The 35 U.S.C. §103 Rejections

Claims 1-16 and 20 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Idaszak (US Patent No. 4,021,927) in view of Vezzani (EP 0710670 A1). According to the Examiner, the Applicant has not provided a specific reason as to why the agitation means of a multi bladed rotor would have been non-obvious. This rejection is respectfully traversed as follows.

As described below, Idaszak and Vezzani disclose different configurations that cannot be combined with each other to properly arrive at the claimed methods.

The Idaszak Reference

The Idaszak Disclosure

Idaszak discloses a reactor for a starch substrate in which the starch substrate and the gas are introduced in opposing directions. The reactor in Idaszak includes three zones in series (see, for example, the Abstract and Figure 1): an upper fluidized zone which is continuously subjected to mechanical agitation and where the starch substrate and reagents are introduced; a lower fluidized zone which is continuously subjected to mechanical agitation and where the gas is

introduced; and a plurality of tubular zones intermediate to the upper and lower zones where the fluidized solids are subjected to heat transfer. Idaszak discloses that the agitation in the lower and upper zones is needed to maintain homogeneity (column 15, lines 45-60). In addition, Idaszak discloses that the starch is rapidly passed through the intermediate tubular zones to prevent scorching of the starch. According to Idaszak, the heat for the drying operation can be supplied solely by the heat exchange medium surrounding the intermediate tubular zone, which provides a high surface area for heat transfer while, at the same time, providing high heat transfer coefficients due to the turbulence of the fluidized starch in the upper and lower zones (column 11, lines 30-35).

Comparison Between Idaszak and the Pending Claims

Idaszak is also very different from the claimed methods in terms of fluid dynamics. In chemical engineering terms, the reactor system of Idaszak comprises a cascade of two continuously ideally stirred tank reactors, each with homogeneous conditions, with a heating zone between them. On the other hand, the claimed methods require a reactor system that includes a single reactor in which a plug-flow-type movement occurs and results from the configuration of the blades. Contrary to the reactor of Idaszak, the conditions in the claimed reactor are not homogeneous; that is, the temperature increases from inlet to outlet, and the amount of modified starch increases from inlet to outlet. In addition, heating occurs continuously by heat exchange with the wall of the reactor. Those skilled in the art of chemical engineering would understand that the hydrodynamics in a cascade of a two-tank reactor is different from the hydrodynamics in a plug-flow reactor. Their behavior is governed by different equations; their residence times are different; the variations of conditions within the reactors are different; and the heating and heat distributions are very different. The reactor configuration in Idaszak is very different from the reactor configuration in the claimed methods and, hence, the two configurations use completely different heat distribution systems.

The Vezzani Reference

The Vezzani Disclosure

The Vezzani reference discloses a reactor system having two reactors in series. See, for example, Example 1, column 4, line 11-44. The reactor system of Vezzani includes a first turboreactor (1 in Figure 1) and a turbodrier (101 in Figure 1). The turboreactor is operated at a

regulated temperature of about 50°C, in which the starch in powder form is mixed with an aqueous solution of hydrochloric acid. The starch forms a thin, tubular, dynamic fluid layer. The hydrochloric acid solution is nebulized finely and introduced into the tubular layer. Residence time of the starch in the turboreactor is approximately 30 seconds. The resulting starch has a moisture content of about 25%. The starch is stirred in the turboreactor having a helical arrangement of blades that are oriented for centrifuging and simultaneously transporting the starch toward the outlet (see, for example, column 3, line 50-54). The acid-modified starch is then supplied to the turbodrier continuously with a flow of hot air in the same direction of flow as the acid-modified starch. The turbodrier has a wall temperature of 120°C, and the moisture of the starch is reduced in the turbodrier from about 25% to about 11%. The starch remains in the turbodrier for about 5 minutes.

Vezzani stated that extreme turbulence is required to prevent the drops of starch-modification agent from coalescing; otherwise, the modification reaction is incomplete (column 2, line 39-43). This is understandable, given the short residence time in the turboreactor (i.e., 30 seconds).

Comparison Between Vezzani and the Pending Claims

The pending method claims require that the flow of air and the flow of starch be in opposing directions. Vezzani does not disclose this feature. In addition, the pending claims require a residence time of between one and 60 minutes at a temperature of between 50 and 220°C. Vezzani discloses that the residence time (in the turboreactor) is about 30 seconds at a regulated temperature of 50°C. Under the conditions of Vezzani, the starch will not reach a temperature above 50°C. Further, new claims 24 and 25 require that one or more particular reagents (e.g., for chemical modification) be added to the starch, while pending claims 1 and 14 recite the optional addition of one or more reagents. Vezzani does not disclose chemically modifying the starch (referring to the turbodrier step).

<u>The Non-Obviousness of the Pending Claims Starting from Idaszak</u>

The skilled person could start from Idaszak. As stated above, the reactor system of Idaszak (i.e., a cascade of continuously stirred reactors at different temperatures) is very different from a plug-flow based reactor system that is used in the pending method claims. Vezzani suggests the use of two separate reactors with plug-flow type movement. However, Vezzani

mentions the difficulty in introducing the modification agent into the tubular starch layer using this type of reactor. Hence, one of skill would not be motivated to modify the reactor described by Vezzani.

One possible combination of Idaszak with Vezzani is that the lower chamber and the tubular zones of Idaszak are replaced by the turbodrier of Vezzani, while the continuously stirred upper chamber of Idaszak remains. However, this combination of Idaszak with Vezzani does not result in the configuration required by the claimed methods.

The Non-Obviousness of the Pending Claims Starting from Vezzani

Alternatively, the skilled person could start from Vezzani. As discussed above, one disadvantage with Vezzani is the risk that the modification reaction is not complete as a result of the difficulty in introducing the droplets into the tubular layer. One may think that the use of a continuously stirred chamber with a longer residence time as disclosed in Idaszak may solve this problem. However, the degree of modification of the starch in a reactor such as Idaszak uses may be lower and could vary more between individual starch molecules. For example, it is well known in the art that, in a tank reactor, the residence time of starch particles can vary significantly, while in a plug flow system, the residence time of starch particles is the same for all starch particles.

In addition, Vezzani mentions that the use of a batch reactor is the only method in which optimal contact between the hydroxylic groups of the starch and the modification agents can be achieved in an industrially advantageous and valuable manner (column 1, lines 33-38). Therefore, it appears that Vezzani considers the continuously operated tank reactor as described by Idaszak unsuitable for modification of starch on an industrial scale. Thus, a combination between Vezzani and Idaszak is not obvious. Moreover, such combination does not result in the reactor system required by the pending claims.

Conclusions

As described above, neither Idaszak nor Vezzani disclose the claimed method and accompanying reactor configuration. In view of the remarks herein, Applicants respectfully request that the rejection of claims 1-16 and 20 under 35 U.S.C. §103(a) be withdrawn.

CONCLUSION

Applicants respectfully request allowance of claims 1-16, 20 and 22-25. If a telephone call to the undersigned would expedite prosecution, the Examiner is encouraged to do so. Please apply the fee for the enclosed Petition for Extension of Time and any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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